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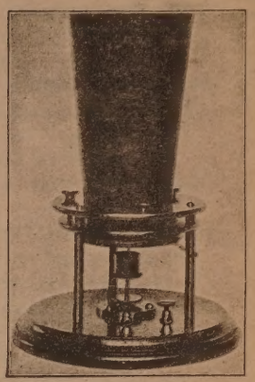
THE NEWSPAPER FOR
THE HOBBYIST OF VINTAGE
ELECTRONICS AND SOUND

THE HORN SPEAKER

TELEPHONE CENTENNIAL
1876 - 1976



Metal Phonograph Records

By Dr. HARRY A. KNAUSS, M.D.

(THEIR INVENTOR)

I HAVE been occupied for over one year on the design and perfection of a playing commercial phonograph record, double disc, made entirely of metal. I have now succeeded in producing this article, samples of which I have successfully demonstrated to the editors. There are certain terms in the phonograph record which will illustrate more clearly than anything else the problems involved in the production of records.

First of these is, "surface." As nearly everyone knows, there is a tremendous weight concentrated on the small area of the needle point. The material carrying the groove which has to sustain this weight and yet track smoothly must be smooth and tough, and should be unbreakable. Heretofore, the nearest approach to these qualities was found in a mixture of shellac, rottenstone, graphite and paper floc, known to the industry as "stock." This mixture, when heated and pressed with dies while warm, takes the impression of the sound grooves from the metal "stampers." These metal stampers are made by electro-deposition of copper, the surface of which is subsequently plated with a very thin coat of nickel. This gives the printing or stamping surface. It is seen that the present method becomes a printing or stamping operation after the proper dies are made.

In the process of making the indestructible metal record, which I have named the Duramel Disc, I carry the electro-deposition several steps further. It is well known that playing records have been made out of copper since the inception of the industry. However, these would not hold up for more than six or eight playings, at most, because the copper soon began to spin under the tremendous weight and the tool action of the sharp needle. Therefore, I first obtained a hard surface by plating an alloy of hard metal directly against the model. This shell is then backed up by electro-deposited copper, as shown in the illustrations. We have, then, a single-faced record, the grooves and playing surface of which *must* be absolutely accurate reproductions, because they are deposited with molecular accuracy.

But it became immediately apparent, in the course of my research that no *single* piece of metal would remain flat under the weight of the heavy tone arm of the phonograph. The single sheet of metal would invariably curl and buckle. Of course this led me to the making of double disc records by placing the single ones "back to back."

After some experimentation, I found that the only thing which would properly hold the two pieces of thin metal together is tin. The front or playing surface is properly protected, the back surface is properly cleaned, and the two shells are then fitted back to back under pressure and heat. I have designed a special device for making this a simple mechanical operation which can be done by almost anyone with proper instruction. The device illustrated can be used to put together two hundred or more at a time.

One of the first questions asked by the practical phonograph man is, "Where are you going to get enough models and get them quickly enough to deposit the metal records?" Suffice it to say that this is one of the things which makes the process commercial, and it is entirely solved. By means of a pressing operation in soft metal, illustrated in the diagrams, it is possible to turn out twelve thousand metal forms a day from two dies and one large press. On these forms are deposited twelve thousand halves, or six thousand whole records in a period of three hours following their being placed in the electrolytic bath.

Thus twelve thousand halves are stript from their models at the end of three hours. The models are then replaced, and the process goes on continuously for twenty-four hours, during which time eight sets of twelve thousand each are stript from the models. This makes a total of 86,000 halves or 43,000 whole records, in 24 hours.

After the first set of twelve thousand is stript from its models, it is necessary to center and trim, after which two hundred halves are placed on a center pin, with tin between the backs, and a disc of copper between the fronts. This string of two hundred is then placed in an electrically heated device, and under pressure, the backs are sweated together so that the result is one hundred perfect playing records. It is thus only necessary to have sixty of these "stoves" in order to put together the twelve thousand halves. This operation requires less than three hours, so that the "stoves" are ready for the next set of shells when they come out.

The number of metal records and the speed of production are entirely dependent on the equipment, which costs only one-tenth as much as that required for the corresponding production of the other type of record.

The result speaks for itself. It has scarcely any surface noise, due to the ideal bearing surface of the metal needle on metal. It is so nearly indestructible that only the most extreme mechanical violence will destroy it. It is fireproof, waterproof, acidproof, rustproof, unbreakable, light in weight (weighing only six ounces, which is two ounces less than the common record of ten inches diameter). The metal record can be sent thru the mails without loss from breakage. It costs less for packing and handling.

The actual material used in the Duramel Disc costs less than six cents, which is less than that of the common record.

Being made almost entirely by electric processes, the energy used can be obtained at a microscopic cost per record, where power is cheap and figures in on a yearly or overhead basis.

Thus it is seen that the metal record is scientifically correct. It is commercial, practical, and the product is indestructible. It can be cheaply made and it is a better article than the present type.

1921

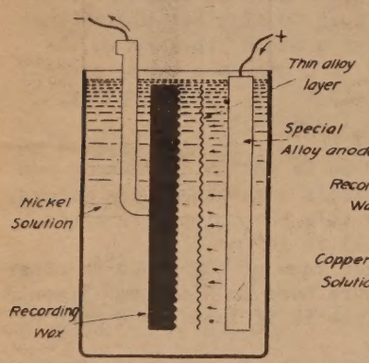


Fig. 1

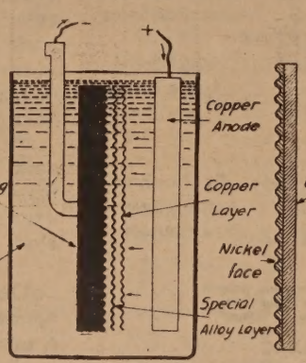


Fig. 2

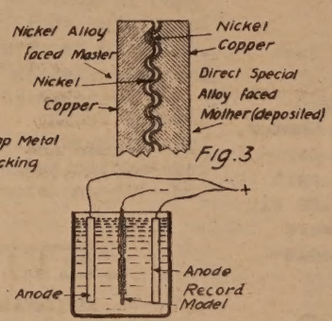


Fig. 3

Science and Invention for October, 1921

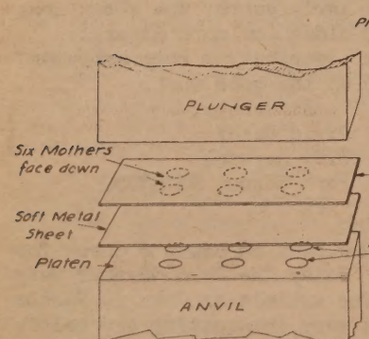


Fig. 4

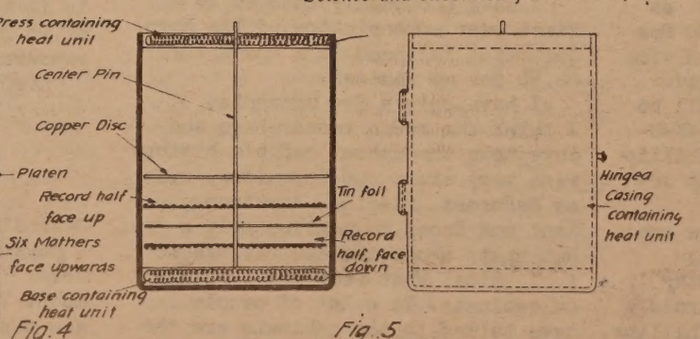
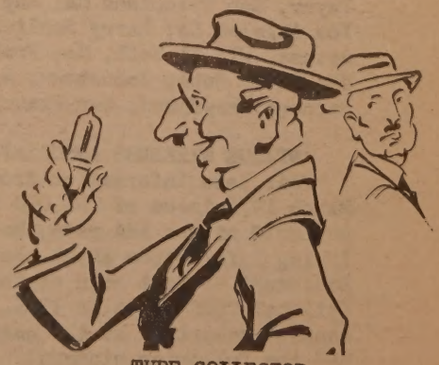


Fig. 5

The Author of the Present Article has Developed a New Process for Making Metal Phonograph Records on a Commercial Scale, Which are Both Lighter and Cheaper Than the Present Records and Moreover, They Play with Practically no Scratching and with Infinitesimal Wear. The Successive Stages in Making the Knauss Metal Phonograph Record, are Shown Above, and Those Familiar with Electroplating Will at Once See How the Problem Has Been Solved. The First or Master Record, Recorded in Wax, Is Made Suitably Conducting by Coating with Powdered Grafite. A Special Alloy Deposition Is First Made on the Wax. Fig. 2—How the Special Alloy Record Is Re-enforced with a Copper Deposit in a Copper Sulfate Bath. Fig. 3—Nickel Alloy Faced "Master" Record, Placed in Special Alloy Bath and Thus a Direct Special Alloy Faced "Mother" Record Is Deposited. Fig. 4 Shows a Scheme for Impressing Six Records on Top and Bottom of Lead Sheet, Which Is Afterward Placed in a Plating Solution and the Record Faces Deposited Thereon. Fig. 5 Shows an Electric Heater for Sweating Two Metal Record Faces Back to Back to Form a Complete Two Faced Record.



TUBE COLLECTOR
Look, what I found, a brass-base WD-11 for 25¢.

Club News

THE BUCKEYE ANTIQUE RADIO AND PHONOGRAPH COLLECTORS' CLUB

The following information about a picnic with items for swap, show and/or sale from SOUNDINGS, the official publication of the club. PICNIC: August 3 (rain date Aug. 10) Ken Spriggel's. Plan to eat at 4pm (but come at 1 for more fun). Bring table service and covered dish or dessert. (Meat & soft drinks provided).

Our annual picnic is the highlight of the year so bring the family for an afternoon of fun. Also, for added enjoyment, please bring items for show, swap and/or sale.

A name and address for the Club is: David A. Lieberth, 490 Mineola Ave., Akron, Ohio 44302.

OLDTIME ANNOUNCERS CLUB

Ray Poindexter is publishing some interesting information about oldtime broadcasting. Announcers with 25 years or more experience are entitled to BROADCAST. There are now two editions. Write to Oldtime Announcers Club, P.O. Box 1174, North Little Rock AR 72115.

SOUTHWEST VINTAGE RADIO AND PHONOGRAPH SOCIETY

Under the direction of Glen Zook the Society planned an exhibit of old receivers and broadcast equipment at the Northpark Shopping Center. All members were encouraged to participate in the event which was part of old time broadcasts put on the air by KERA-FM. These activities were planned for the first week to celebrate National Radio Week.

THE AMERICAN PHONOGRAPH SOCIETY 1976 OFFICERS

Art Wilmoth, was re-elected as the president. Advisor Clifford Dew of Northfield, Ohio was elected vice president. Dave Fletcher is again the secretary-treasurer and will be the editor of the JOURNAL and NEWSLETTER for another year. Dr. Phillip Petersen remains as the society archivest.

By the way the 1976 advisors are: John V. Danner, Metuchen, N.J.; Tim Christen, Belmont CA; Timothy Fabrizio, Bergen, N.Y.; Dr. Harold Layer, San Francisco CA; Ray Phillips, Los Angeles CA; Larry Schlick, Wauwatosa, WI; Al Sefl, San Francisco CA; Peter Betz, Johnstown, N.Y.: Bernard Skagfjord, San Francisco CA.

ANTIQUE WIRELESS ASSOCIATION

This late information from the March 1976 issue of THE OLD TIMERS BULLETIN of the AWA gave the following information about the Old Equipment Contest held at the National Conference in 1975. The contest described as the best ever, had the following winners:

CLASS I REGENERATIVE RECEIVERS
1st--Grebe CR-6 Lauren Peckham
2nd--Paragon RA-10 Alan Douglas
3rd--Remler Panel John W. Johnson
3rd--DIMA (German) John Caperton

CLASS II CRYSTAL SETS
1st--1917 Cohen Ralph Muchow
2nd--Nesco CN-113A Tom Brooker
3rd--Wireless Improvement Wavemeter Joe Pavek

CLASS III TUNED RF RECEIVERS
1st--AK-9 & Log F. W. Sloat
2nd--Kennedy XV Gary Schneider
3rd--Grebe MU-1 Ray Sieracki

CLASS IV SUPERHETS
1st--Magnaformer John Caperton
2nd--1924 Receptrad Alan Douglas
3rd--Leutz Model C Lauren Peckham

CLASS V TUBE TRANSMITTERS
1st--1919 Grebe Ralph Muchow
2nd--DeForest OT-3 Tom Brooker
3rd--VT-2 Modulated oscillator Wilson Norwood

CLASS VI SPARK TRANSMITTERS
1st--Torikata 1910 Ralph Muchow
2nd--Clapp-Eastham ¼kw. Tom Brooker

CLASS VII LOOSE COUPLERS
1st--Metero 1919 Ralph Muchow
2nd--Cliff Navy Lauren Peckham
3rd--Homebrew F. W. Sloat
3rd--Antenna Tuner A.G. Wentzel

CLASS VIII LOUD SPEAKERS
1st--Clapp-Eastham horn Burt Noyes
2nd--Magnavox R-2 horn Gary Schneider
2nd--Two Sarnoff horns Ralph Muchow
3rd--L.E. Knott Mod.B John Johnson

CLASS IX AUDIO AMPLIFIERS
1st--DeForest 1915 Audio L.Whitlock
2nd--1920 Magnavox D.Cleland
3rd--Porcelaines 1917 (French make) L.Peckham

CLASS X TUBES
1st--Pickard 1915 Triode R. Muchow
2nd--Audion(Wallace) A.Douglas
3rd--Pingen detector S.Johnson

LETTERS

EDITOR'S MAILBAG

Dear Jim:

I have thoroughly enjoyed my first year subscription of The Horn Speaker. Enclosed is a check for $4.50 for my renewal.

I have only a few comments. I think the radio researchers and inventors throughout radio's history were very sharp and ingenious, such as DeForest, Fleming, Armstrong, Kent and Scott to mention only a few. But what about the cabinet makers for radios? What were the theories on cabinets? To a lot of people I have talked to the cabinets are the eye catch. Did the previously mentioned radio geniuses also design, experiment and develop the cabinets with their fancy designs and selected choices of wood grains? Or, did they leave this to a separate group of people, such as Pooley? What about the colorful separate speaker cabinets and housings? What about the speaker cloth designs?

In your opinion based upon your experience and the experiences of others which cabinets were considered the fanciest and best looking?

These are a lot of questions among others that I am curious about. Perhaps you may have an article on some of these items some day, or else I've missed them. Your paper is very good. I wouldn't miss it for the world. Thank you for the reading enjoyment.

Sincerely yours,
Ivan L. Johnson
313 Alice St.
Deer Park TX 77536

Ed: A good idea for an article.

Dear Mr. Cranshaw:

Enclosed is a check for $2.46 for an ad.

I really enjoy The Horn Speaker. Thanks to Keith Parry for telling me about it.

I started collecting radios about 2 years ago when I was 14. I'm still at it and save up my money from a paper route to buy them. My main source is garage sales.

What got me on this, was a local radio station playing old radio programs. I thought it would be nice to have a cathedral style to listen to them on. During my search, I was surprised to see the wide variety of items available. After quite a search, I finally got a U.S. Radio & T.V. Cathedral type. What a mess it was! The radio wasn't much to fix, but the cabinet took over a month, working on the average of 4 nights a week, several hours each night. It's now one of several I now have.

Now I go through list after list sent to me by fellow collectors and hope there's something I can afford. Usually it's the shipping charges that kill it for me.

Do you know of any clubs or other collectors here in Michigan? I would appreciate it if they would drop me a card.

I would like to see more first hand accounts of the radio industry in it's early years. How about some of your older (or more mature!) readers contributing some articles?

Keep up the good work.

Sincerely,
David Dazer
2989 Maywood
Port Huron MI 48060

Dear Jim:

Enclosed is an ad, and check for same. I enjoy The Horn Speaker very much. The article on John A. Victoreen was very interesting and helpful to me, but I need more information.

I recently picked up an old radio with the name 'Imperial Superhetrodyne' on the H.R. panel, also dial markings, Tuner, Oscilator, Vol. Rheostat, Loop Ant. and speaker jacks. It had 8-20laux tubes in it. Parts are mounted on a wood chassis base, with a ser. #1072. It is bus-bar wired, well designed and constructed. All R.F. transformers are marked and labeled, Victor Products, Victoreen Radio Inc., Cleveland, Ohio. I would like to know if it was a kit set, custom built, or manufactured. It surely doesn't look like 'home brew:' as I have seen

many of those, having built many in the early twenties. Also what year it was made. I have it restored and it works beautifully. I would appreciate any help or information of any kind about it. Many thanks.

Sincerely,
Herb. DeGarmo
203 3rd. St.
Early, Iowa 50535
Phone: 712 273-3571

Editor: Ray Windrix and Dr. Victoreen will probably help us.

Dear Jim:

In reference to the March issue, you pictured a Crosley Book Case receiver. Inclosed is a picture of a Sentinel Book radio which I have. Although not too old, it is still rather unusual. It is 10½" H X 6" W X 7½" deep. Uses 3525, 5016, 12SQ7, 12SK7, 12SA7. Model 238, 115AC-DC, 1940s??

Gary B. Schneider
6848 Commonwealth Blvd.
Parma Hgts., Ohio 44130

Dear Mr. Cranshaw:

I received my copies of The Horn Speaker and I want to say that I find them very enjoyable to read and also, they are filled with very informative information about old radios and phonographs. Am very satisfied with it, keep up the good work.

Would like to see more articles on collecting records, about dating them and also steps in their care, that is storing them and cleaning the dirt off of them. Thank you and best wishes.

Sincerely,
William Smith
Hyattsville, Maryland

Ed: We are looking for more articles to print about records.

Dear Mr. Cranshaw:

Inclosed is a check covering the cost of a renewal of The Horn Speaker. I really enjoy it.

I've been in the electronic repair field, working as a bench tech., for about 10 years now. And I've worked on everything from video tape recorders to muti-band portable radios. Everything is just getting more complicated and difficult. I find those old circuits and articles a breath of fresh air.

Keep up the good work.

Yours truly,
Louis K. Yadevia
601 Church La.
Upper Darby PA 19082

DOWN MEMORY LANE

THOMAS H. "TOMMY" COWAN was the first announcer in the Greater New York area. WJZ, Newark was put on the air by Westinghouse in September 1921. The transmitter had been sent from Pittsburgh and was like the one at KDKA. Cowan was a company employee and was selected to do the talking.

"This is WJZ, WJZ, WJZ, the radio telephone broadcasting station located in Newark, New Jersey. Please stand by to tune your sets. This is announcer Cowan, Newark." After awhile, he shortened it to "ACN."

During the first few nights, there was no program--just talk by Cowan. Even this brought a considerable amount of mail. Cowan decided to put some music on the air. His first job had been with Thomas Edison at Orange, N.J. He went to see Edison to borrow some records. The inventor didn't like radio. Apparently, he thought some of his discoveries had been used in its development. Regardless of his feelings, Edison lent his former employee some records.

WJZ began broadcasting the World Series between the Yankees and the Giants October 5, 1921. Cowan's voice was heard reporting the action, but he was not at the game. A newspaper reporter relayed the happenings by telephone and Cowan repeated them into the mike. It was such a trying task that when the game was over, he didn't even realize which team had won. (The Yankees won the first game, But the Giants took the series.)

WJZ moved to New York the following year, and RCA acquired the station in 1923. Cowan left to join WNYC, the city-owned station, as chief announcer when it went on the air in July 1924.

Recently, I called his former address in New York and learned that Cowan died about three years ago. I talked to former radio actor Frank Ryan, who had known Cowan well.

From Broadcast No. 2, Oldtime Announcers Club, P.O. Box 1174, North Little Rock AR 72115.

REACTIVATION OF THE THORIATED TUNGSTEN FILAMENT VACUUM TUBE

By O.H. McDonald

The process of rejuvenation for the vacuum tube was one of the many secrets of radio that the old-timers used some fifty or sixty years ago. Try it ----- it will give you just another phase of enjoyment in the study of vintage radio. In placing my mind and thoughts in those yesteryears helps to give me the fulfilment of this fascinating hobby of antique radio collecting.

In the 1920s vacuum tube rejuvenation was not only an art but a big business. Radio tubes for the home receivers on the average sold for around $5.00 each. Many so called "black market" tubes were sold for about one half of that amount. The "black market" tubes being the ones that were extremely weak and for all practical purposes had been discarded. Many of these tubes were rejuvenated and sold at the cheaper price with actually a higher profit. Around the mid 20s manufacturers began producing rejuvenators for the service man. This was a big factor in helping to cut the ever rising cost of repairing the home receiver. In this article my intention is to cover the general rejuvenation process for the collector. An understanding of this proceedure will enable the enthusiast to possibly reactivate some of his weak emitting tubes. However, I would suggest that you cover this complete article before attempting this process of rejuvenation.

Tubes are usually constructed with tungsten wire filaments. The number of electrons thrown off by such filaments is greatly increased when a chemical known as thorium is added to the tungsten wire when it is manufactured. Filaments having thorium drawn with the tungsten wire are known as thoriated tungsten filaments. Tubes having thoriated tungsten oxide filaments operate at a much lower temperature than those with other types of filaments and therefore throw off very little light.

Tubes with thoriated tungsten filaments are the only ones that can be rejuvenated. If the filament is burning and the emission is low or even zero, more than likely the tube can be revived. Tubes that have been badly overloaded may not improve, but I will cover a "flashing process" for these tubes before you throw them away.

The filament condition of a tube may be most readily judged by an emission test using the circuit shown in figure #1. The voltages

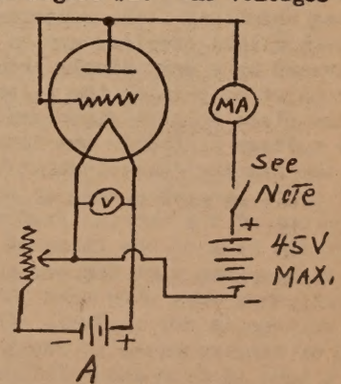


FIGURE #1 EMISSION TEST CIRCUIT

note.. CLOSE SWITCH JUST LONG ENOUGH TO GET READING ON MA. METER AFTER FILAMENT VOLTAGE HAS BEEN ADJUSTED TO RATED VALUE. DISREGARD CHANGE IN FILAMENT VOLTAGE WHICH WILL OCCUR WHEN EMISSION CURRENT FLOWS. TEST FOR SHORTED ELEMENTS BEFORE TAKING EMISSION READING

specified should not be exceeded. Higher voltages will possibly damage the vacuum and may even result in a burnout. If the emission is above the minimum value specified in the

table, the tube is in good condition and does not need reactivating. If equipment for reading emission is not available a simple test for the two most widely used tube types can be made on the customary tube test set which measures plate current. This circuit is shown in figure #2.

For UX-199 or CX-199 tubes, set the plate voltage at 45 volts with the grid connected to the negative side of the filament, set the filament voltage at 3.0 volts and read the plate current. Momentarily increase the filament voltage 3.5 volts and read the plate current. If the plate current increases more than .2 MA, the filament is not fully active and the tube may be improved by the reactivation process.

For the UX-201A or CX-201A tubes, the same plate voltage of 45 volts is used but the plate current is read with the filament voltages set at 4 volts and 6 volts. An increase of more than .2 MA in the plate current indicates that the tube may be improved by reactivation.

If the tube will not return to normal after reactivation treatment it is proof that the tube has either served its normal life or has been so heavily overloaded that the thorium content has been exhausted or the vacuum impaired.

METHOD OF REACTIVATION -- The following methods will generally restore the emission, that is reactivate, tubes which have been overloaded and also, at times, will reactivate, for short additional usage, tubes that have dropped in emission at the end of a normal life. The exact process which gives the best results depends upon the overload to which the tube has been subjected.

Tubes which have been subjected to only a slight overload may be reactivated by a very simple process. This consist of burning the filament, with the plate voltage disconnected, at the voltage listed in the table under the heading 'Reactivation Voltage.' This process speeds up the boiling out of the thorium from the body of the wire of the filament while at the same time the surface evaporation is very slow when the plate voltage is not applied. The length of time required to reactivate a tube is from about fifteen minutes to two hours, depending on how long the tube was subjected to excessive voltages. At the end of fifteen minutes, test the tube as explained in the preceeding paragraphs. If the emission shows improvement continue the treatment until the tube tests above minimum passing limit.

Tubes which have been badly overloaded may not improve during this process, and a 'flashing' voltage may be used, as outlined in the next paragraph.

First burn the filament for ten

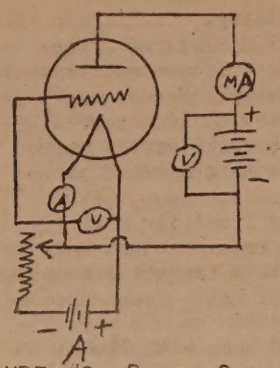


FIGURE #2 PLATE CURRENT TEST CIRCUIT

or fifteen seconds at the 'flashing voltage.' Then burn the filament under the process first discribed, using the reactivation voltages. Read the emission at the end of about thirty minutes and if not improved, continue to burn the filament for about two hours, taking reading every twenty to thirty minutes. If a couple of hours treatment does not restore emission or greatly improve it, then the tube can not be reactivated. No plate voltage is every applied during reactivation. The applied voltages should always be monitored by a suitable volt meter. A small percentage of the tubes reactivated by the 'flash voltage' process may be expected to burn out during the flashing period, but these are the tubes at or near the end of their normal life.

Rapid reactivation, sometimes within ten minutes, can be accomplished by the use of voltages higher than those recommended in the chart. This process very materially shortens the tube life and such reactivation is generally not permanent. Furthermore, the usage of higher voltages greatly increases the percentage of tubes that burn out and the filaments are in worse shape than they were before the process started. This hurry up process of rejuvenation should be highly discouraged.

REACTIVATION EQUIPMENT -- Alternating current from the house voltage supply is most convenient and can be stepped down to the proper voltage by a toy or bell ringing transformer. There are numerous step down transformers available with several step-down taps to select from. Connect the transformer in series with a 15 to 20 OHM variable resistor and the filament as shown in figure #3. Again use a suitable volt meter in adjusting voltages. Most A.C. voltmeters draw heavy currents and should not be left connected to the circuit for long periods of time. If an alternating supply is not available any direct voltage supply can be used. The larger voltages for flashing may be obtained from 'B' batteries. Only one tube should be reactivated at a time in order to keep a close watch on the voltages at all times.

NORMAL OPERATION PRECAUTIONS -- If it is necessary to reactivate tubes at frequent intervals, it is proof that the tubes are being overloaded, and better service can be obtained if the following precautions are observed:

(1) Do not operate filaments at higher voltages than what they are rated. Keep the filament

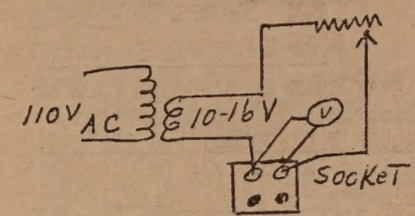


FIGURE #3
REACTIVATING CIRCUIT

rheostat set as low as possible, if possible use a reliable volt meter.

(2) Do not use high plate voltages unless 'C' batteries are used. With types C-299, CX-299, UV-199, UX-199, and CX-301A, UV-201A and UX-201A better life is obtained, and 'B' battery current drain is lessened when a voltage of 67½ voltage or less is used in the plate circuit in case no 'C' battery is provided.

(3) Be careful when changing battery connections to see that the battery polarities are not reversed. If the leads connecting the filament supply or the grid bias supply are reversed, the signals and music may still be heard, but they will be faint and distorted. Such a reversed condition often causes the operator to turn the filament voltage to a higher setting, thus injuring the tube without an appreciable results. Al-

TUBE TYPE	FILAMENT VOLTAGE	PLATE VOLTAGE MAXIMUM	MINIMUM EMISSION	MAXIMUM REACTIVATION VOLTAGES	MAXIMUM FLASHING VOLTAGE
199 OR 299	3.3	50	6 MA	4.0	10
120 OR 220	3.3	50	15 MA	4.0	10
201A - 301A	5.0	50	25 MA	7.0	15
200A - 300A	5.0	50	12 MA	7.0	15
171 OR 371	5.0	50	50 MA	7.0	15

TABLE OF EMISSION CURRENT AND REACTIVATION VOLTAGE

ways check battery connections after making any change.

(4) If an insensitive tube and a tube in perfect condition are operated from the same rheostat, there will be a tendency to overload the good tube in order to obtain a better response from the weaker tube. The weaker tube should be reactivated or replaced. Here again the use of a reliable volt meter for the filaments will save overloading the tubes.

(5) When using C-299, CX-299, CX-220, UV-199, UX-199, UX-120 types and a filament volt meter is not available, the operation of the set may be checked as follows: Connect two fresh dry cells in series (3V) for the heater voltage. The rheostats now may be turned on full (no resistance) and if the set and tubes are operating correctly, satisfactory reception will be obtained. If the results are not satisfactory check batteries, battery connections, aerial connections and tubes. The two fresh dry cells will offer satisfactory reception when the trouble is located in the receiver.

GENERAL COMMENT -- The voltages specified in the table are the maximum which should be used. A volt meter should be used to set the applied voltages to the proper values in order to obtain the proper results.

Tubes which have internal shorts between elements can not be reactivated and it may be convenient to make the short test with an OHM meter. If an OHM meter is not available a pair of headphones and a dry cell connected in series will work satisfactory in locating shorts if they exist. When the tube is not lighted, there should be an open circuit between the plate and the grid, the plate and the filament, and the grid and the filament. There should be a closed circuit between the two filament connections.

Tubes in which the vacuum is impaired can not be reactivated. This is usually indicated by a filament

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current reading above rated value. If considerable air is in the tube, the filament will not light up at all unless the voltage is raised considerably above the rated value, in which case the filament may burn out.

Cunningham types C-11, CX-12, and CX-200 and radiotron tubes as WD-11, WX-12, UX-112 do not use thoriated tungsten filaments and can not be reactivated.

TESTING THE 200A and 300A DETECTOR TUBES -- The UX-200A or the CX-300A tube is designed only for service as a detector and differs from the other types of tubes in that it contains an alkali vapor. The formation of the vapor occurs during the first three minutes after the tube is lit, during which period the tube characteristics change rapidly causing variation in the plate current and preformance of the tube when operating in a radio receiving set. As soon as the tube warmed up, or at the end of about three minutes, the readings become uniform and no further changes occur. As a result of this action, readings taken during the period of change are variable, and are of no value. However, since the change does not usually began until about one minute after the voltage has been applied to the filament, it is possible to make a quick test immediately after the voltage has been applied, otherwise, the readings should be taken at the end of the three minute warm up period.

Tests on the 200A and 300A series tubes should be made with a plate voltage of 45 volts and no higher voltage should be used. Since these tubes are designed for detector service only, a thorough test of the tubes require considerable equipment. Plate current readings, such as taken in the average test sets, indicate only the condition of the filament and can not be depended upon as a test of the detector sensitivity. For that reason the best practical test for the tube is a check of the operation obtained under actual service conditions in a receiver, with a weak incoming signal being preferred. Quick test during the first minute of warm up will usually suffice, but if any doubt as to the satisfactory performance of the tube arises, it should be allowed to warm up the full three minutes before attempting to complete the test.

A plate current reading obtained with this tube when used in a radio receiving set with a grid condenser and a grid leak is quite different than that obtained in a test set. Under usual conditions the plate current is approximately 1 MA, varying only slightly from this value regardless which side of the filament the grid is connected. The difference in reading as compared with those obtained in a test set is due to the fact that the grid current furnished by this tube is sufficient to establish a voltage drop in the grid leak equivalent to the use of a grid bias voltage of 2 to 2½ volts.

Under certain conditions a hiss is produced at the time the plate current noted in the preceeding paragraph occurs. If a milliampere meter is placed in a detector plate circuit, it will be noted that the initial reading is about 1 MA remaining at this value for the first minute, while during the second minute the plate current rises slowly to 2 or even 3 MA. It is during this change that the hiss sometimes occurs. The plate current then returns to a value close to the initial value and then the tube will operate quitely.

There are several reasons for not testing these tubes at voltages no higher than 45 volts, first it does not represent the operating conditions of the tube, secondly the grid biasing voltages are often applied when testing at higher voltages. Because of the amplification constant of the tube the plate current will be practically blocked at 90 volts on the plate, if the ordinary voltage of minus 4½ volts is applied to the grid, the reading will be only a fraction of a milliampere.

When a test of the filament conditions and the short test only is desired, the readings from the ordinary tube test set will be found satisfactory. A sample reading using a detector tube 300A at a filament voltage of 5 volts and a plate voltage of 45 volts. During the first minute of warm up the plate drew 1.6 MA with the grid connected to the minus side of the filament and 6.1 MA with it connected to the positive side of the filament. After the three minute warm up the plate drew 2.1 MA with the grid connected to the minus side of the filament and 6.2 MA when the grid was connected to the positive side of the filament. These drastic changes in plate current are due to the formation of the alkali vapor in the detector tubes. The detector tubes are the only tubes required to warm up such a long period of time in order to make the various emission test we have been speaking of in the previous paragraphs.

REACTIVATING POWER TUBES -- The power tubes such as the 203A, 204A, 210, 211, 213, 216B and the 852 can be reactivated only if they have the thoriated tungsten filament. On these tubes the flashing voltages is twice the rated voltage and should not be applied over fifteen seconds. The reactivating voltages are only 20% higher than the rated voltage for the filament. The time required for reactivating is two to fifteen minutes. If the emission is not up to the rated value then the tube has run its normal life.

If you readers have access to some of the old radio books you can find interesting reading on the art of rejuvenation of the vacuum tubes. As a reference I have used a book titled 'The Radio Manual' by George E. Sterling published in 1926. I hope you have gained knowledge from this article and can use it in search for better operation of your radio relics.

O. H. McDonald is a collector of vintage radios and apparatus. In the mid 40s he was instructor of classes on the theory of basic radio and electricity.

MART

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FOR SALE: Old wall telephone, Central Telephone & Electric Co., St. Louis MO. Has nicely nickel plated magnets but needs receiver and bells need plating, also have old desk phone with poor receiver. Will sell to best offer. I need AK speaker model E2 or E3. Hugh E. Kuhn, Rt3, Lime Springs, Iowa 52155. Phone: 319 547-2498.

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WANTED: Cabinet for Federal 59. Would consider good replica. Also looking for any Marconi items. Have Edison gold molded cylinder records - 2 minute - for sale - make offer. Pat Stewart, W7GVC, 1404 Ruth, Walla Walla, Wash. 99362.

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PUBLISHERS OF

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OA4	$2.	1LG5	$4.	5Z4	$3.	6F8	$3.	6V7	$4.	12A5	$4.	14B8	$3.	35Z3	$3.	83	$3.	5691	$3.
OB3	$2.	1LH4	$4.	6A3	$5.	6G5	$4.	6W6	$3.	12A6	$3.	14C5	$3.	35Z4	$2.	83V	$3.	5703	$3.
OC3	$2.	1LN5	$4.	6A4	$6.	6G6	$3.	6X4	$2.	12A7	$4.	14C7	$3.	35Z5	$3.	84	$3.	5749	$2.
OD3	$2.	1N5	$4.	6A5	$4.	6H6	$2.	6X5	$2.	12A8	$3.	14E6	$3.	35Z6	$3.	85	$3.	5751	$2.
OY4	$3.	1N6	$4.	6A6	$4.	6J5	$3.	6Y5	$3.	12AH7	$3.	14E7	$3.	36	$3.	89	$3.	5814	$2.
OZ4	$2.	1P5	$4.	6A7	$5.	6J6	$2.	6Y6	$2.	12AT6	$2.	14F7	$3.	37	$3.	117L7	$4.	5879	$2.
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1A3	$3.	1R5	$2.	6AB4	$3.	6J8	$3.	6Z4	$3.	12AU6	$2.	14H7	$3.	39	$3.	117N7	$7.	5992	$2.
1A4	$3.	1S4	$2.	6AB7	$3.	6K5	$3.	6Z5	$2.	12AU7	$2.	14J7	$3.	40	$6.	117P7	$7.	6080	$3.
1A5	$3.	1S5	$2.	6AC5	$3.	6K6	$3.	6Z7	$2.	12AV6	$2.	14N7	$3.	40Z5	$2.	117Z3	$4.	6146	$4.
1A6	$3.	1T4	$3.	6AC7	$3.	6K7	$3.	6ZY5	$3.	12AX7	$2.	14Q7	$3.	41	$3.	117Z4	$4.	6188	$3.
1A7	$3.	1T5	$3.	6AG7	$3.	6K8	$3.	7A4	$3.	12B7	$3.	14R7	$3.	42	$3.	117Z6	$4.	6842	$2.
1B4	$3.	1U4	$3.	6AK5	$2.	6L5	$4.	7A5	$3.	12B8	$4.	14W7	$3.	43	$3.	485	$4.	6973	$2.
1B5	$3.	1U5	$3.	6AK6	$2.	6L6	$3.	7A6	$3.	12BA6	$2.	14X7	$3.	44	$3.	807	$4.	7025	$2.
1B7	$3.	1V	$4.	6AL5	$3.	6L7	$3.	7A7	$3.	12BE6	$2.	15	$5.	45	$5.	809	$6.	7193	$2.
1B8	$3.	2A3	$6.	6AL7	$4.	6N5	$4.	7A8	$4.	12C5	$3.	19	$4.	45Z3	$2.	837	$4.	9002	$3.
1C1	$4.	2A4	$5.	6AQ5	$2.	6N6	$3.	7AE7	$4.	12C8	$3.	19T8	$2.	45Z5	$2.	843	$3.	9003	$3.
1C5	$3.	2A5	$4.	6AQ7	$4.	6N7	$3.	7AF7	$4.	12F5	$3.	22	$5.	46	$6.	879	$2.	9004	$4.
1C6	$3.	2A6	$3.	6AS7	$3.	6P5	$3.	7AG7	$4.	12H6	$3.	24A	$3.	47	$5.	884	$7.	VR-	
1C7	$5.	2A7	$5.	6AT6	$2.	6Q7	$3.	7B4	$3.	12J5	$3.	25A6	$3.	48	$4.	923	$3.	90	$2.
1D5	$5.	2B7	$3.	6AU6	$2.	6R7	$4.	7B5	$3.	12J7	$3.	25A7	$3.	49	$4.	930	$3.	VR-	
1D7	$5.	2C26	$2.	6AV5	$2.	6S4	$4.	7B6	$3.	12K7	$3.	25AC5	$3.	50	$6.	950	$3.	105	$2.
1D8	$4.	2E5	$4.	6AV6	$2.	6S8	$3.	7B7	$3.	12K8	$3.	25B6	$3.	50A5	$3.	951	$3.	VR-	
1D21	$3.	2E30	$2.	6AX5	$2.	6SA7	$2.	7B8	$3.	12L6	$2.	25C6	$2.	50B5	$2.	955	$4.	150	$2.
1E5	$5.	2V3	$4.	6B4	$5.	6SB7	$3.	7C5	$3.	12Q7	$3.	25L6	$3.	50C5	$2.	958	$4.	VT-	
1E7	$4.	2W3	$4.	6B5	$5.	6SC7	$3.	7C6	$3.	12S8	$3.	25S	$3.	50C6	$3.	1005	$3.	52	$4.
1F4	$4.	2X2	$2.	6B6	$5.	6SD7	$3.	7C7	$3.	12SA7	$3.	25Z5	$3.	50L6	$3.	1100	$2.	XXB	$3.
1F5	$4.	3A4	$3.	6B7	$5.	6SF5	$3.	7E6	$3.	12SC7	$3.	25Z6	$3.	50X6	$3.	1201	$3.	XXFM	$3.
1F6	$4.	3A5	$3.	6B8	$3.	6SF7	$3.	7E7	$3.	12SF5	$3.	26	$4.	50Y7	$3.	1203	$3.	XXL	$3.
1F7	$5.	3A8	$3.	6BA6	$2.	6SG7	$3.	7F7	$4.	12SF7	$3.	26A6	$4.	51	$3.	1232	$3.		
1G4	$4.	3C6	$3.	6BE6	$3.	6SH7	$3.	7F8	$4.	12SG7	$3.	26A7	$4.	53	$5.	1273	$3.		
1G5	$4.	3LF4	$5.	6BJ6	$2.	6SJ7	$3.	7G7	$3.	12SH7	$3.	27	$3.	55	$4.	1612	$3.	MAJESTIC:	
1G6	$4.	3Q4	$3.	6C4	$2.	6SK7	$3.	7H7	$3.	12SJ7	$3.	28D7	$3.	56	$3.	1620	$3.		
1H4	$5.	3Q5	$3.	6C5	$3.	6SL7	$3.	7J7	$3.	12SK7	$3.	30	$3.	57	$3.	1625	$4.	G4S	$5.
1H5	$3.	3S4	$2.	6C6	$3.	6SN7	$2.	7K7	$3.	12SL7	$3.	31	$3.	58	$3.	1626	$3.	2A6	$4.
1H6	$3.	3V4	$2.	6C7	$4.	6SQ7	$3.	7L7	$3.	12SN7	$3.	32	$3.	59	$4.	1629	$4.	2B7	$3.
1J6	$4.	5AZ4	$4.	6C8	$4.	6SR7	$3.	7N7	$4.	12SQ7	$3.	32L6	$3.	70A7	$3.	1633	$3.	G31	$4.
1L4	$4.	5R4	$2.	6CB6	$2.	6SS7	$3.	7Q7	$3.	12SR7	$3.	32L7	$2.	70L7	$3.	1634	$3.	6C7	$4.
1L5	$6	5T4	$2.	6D6	$4.	6ST7	$3.	7R7	$3.	12V6	$3.	33	$3.	71A	$6.	1635	$3.	6D7	$4.
1LA4	$4.	5U4	$2.	6D7	$4.	6SU7	$3.	7S7	$3.	12W6	$3.	34	$3.	75	$3.	1656	$3.	6E7	$4.
1LA6	$4.	5V4	$2.	6D8	$4.	6SV7	$3.	7V7	$3.	12X4	$2.	35	$3.	76	$3.	1852	$3.	46B1	$5.
1LB4	$4.	5V6	$2.	6E5	$4.	6T7	$4.	7W7	$3.	12Z3	$2.	35A5	$4.	77	$3.	1853	$3.	G46A1S	$5.
1LC5	$5.	5W4	$2.	6E6	$4.	6T8	$2.	7X6	$3.	14A4	$3.	35B5	$2.	78	$3.	2050	$3.	G625	$3.
1LC6	$4.	5X4	$3.	6E7	$4.	6U5	$4.	7X7	$3.	14A5	$3.	35C5	$2.	79	$3.	2051	$3.		
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